Arthroscopic Debridement Versus Refixation of the Acetabular Labrum Associated With Femoroacetabular Impingement

Mean 3.5-Year Follow-up

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Background: The acetabular labrum provides a sealing function and a degree of hip joint stability. Limited, short-term follow-up studies suggest that labral refixation/preservation leads to superior outcomes compared with labral debridement/excision.

Purpose: To compare the results of labral refixation versus focal labral excision/debridement in a cohort of patients who underwent arthroscopic correction of femoroacetabular impingement (FAI).

Study Design: Cohort study; Level of evidence, 3.

Methods: We reported on patients who underwent labral debridement/focal labral excision during a period before the development of labral repair techniques. Patients with labral tears thought to be repairable with our current arthroscopic technique were compared with a cohort of patients who underwent labral refixation. To better match the 2 groups, only patients with labral pincer- or combined-type FAI were included. In the first 44 hips, the labrum was focally excised/debrided (group 1); in the next 50 hips, the labrum was refixed (group 2). Outcomes were measured with the modified Harris Hip Score (HHS), Short Form 12 (SF-12), and a visual analog scale (VAS) for pain preoperatively and postoperatively. Preoperative and postoperative radiographs were obtained to evaluate bony resection.

Results: The mean age was 32 years in group 1 and 28 years in group 2 with a mean follow-up of 42 months (range, 24-72 months). Preoperative mean subjective outcome scores were not significantly different between groups. At a mean 3.5 years follow-up, subjective outcomes were significantly improved (P < .01) for both groups compared with preoperative scores. The HHS (P = .001), SF-12 (P = .041), and VAS pain scores (P = .004) were all significantly better for the refixation group compared with the debridement group at the most recent follow-up. At a mean 3.5 years follow-up, good to excellent results were noted in 68% of the focal excision/debridement group and 92% of the refixation group (P = .004).

Conclusion: Although other factors may have influenced these results, labral refixation compared with an earlier cohort of focal labral excision/debridement resulted in better HHS, SF-12, and VAS pain outcomes and a greater percentage of good to excellent results at a mean 3.5-year follow-up.

Keywords: hip arthroscopy; femoroacetabular impingement; hip; hip labral tears

References 1-4, 8, 11, 12, 16, 17, 18, 20.

Recent literature suggests that the hip labrum may play an important role with respect to hip joint preservation procedures and maintaining hip joint integrity. A previous study by the current authors evaluating patients after arthroscopic focal labral excision versus labral refixation in the setting of pincer-type impingement showed better clinical outcomes in the refixation group at a minimum 1-year follow-up. Three other studies looking at labral excision/debridement versus...
labral preservation have also reported better outcomes with labral preservation/refixation as part of an open or arthroscopic femoroacetabular impingement (FAI) corrective procedure. The purpose of the current study was to report an update of labral refixation versus focal excision/debridement at a minimum 2 years’ follow-up. Our hypothesis was that better outcomes would be maintained over time for the labral refixation group compared with the focal excision/debridement group in the setting of arthroscopic treatment of FAI.

MATERIALS AND METHODS

Arthroscopic management of pincer-type FAI has been performed by the current authors since November 2004. Initially, this consisted of focal labral excision/debridement followed by resection of the acetabular rim. Beginning in June 2006, we performed labral takedowns to resect acetabular rim overcoverage, followed by labral refixation when appropriate. The indications for acetabular rim resection included a combination of imaging and intraoperative findings consistent with pincer-type impingement. Radiographic and intraoperative findings consistent with pincer-type FAI in this cohort have been previously described. Pincer-type pathological changes can be secondary to acetabular retroversion, focal anterior overcoverage, coxa profunda, or protrusion acetabuli. Pincer-type findings were defined on a well-centered anteroposterior plain radiograph. Acetabular retroversion was present when there was a crossover sign, a positive posterior wall sign, and a lateral center edge (LCE) angle greater than 25°. Focal anterior overcoverage was present when there was a crossover sign, a negative posterior wall sign, and an LCE angle greater than 25°. Coxa profunda was present when the tear drop was medial to the ilioischial line with an LCE angle greater than 35°. Protrusio acetabuli was present when the medial aspect of the femoral head was medial to the ilioischial line. Cam-type FAI was present when the alpha angle was greater than 55° on plain radiographs.

Our indications for labral refixation included a hip with pincer- or combined pincer-type and cam-type impingement, labral injury, and an adequate amount of healthy labral tissue available for refixation. An ideal labrum for refixation lacked significant intrasubstance degeneration, calcification, ossification, and complex degenerative tearing and was typically located anterosuperiorty. To compare the results of this method, we retrospectively reviewed the operative reports, intraoperative images, and preoperative imaging studies of those patients treated before using refixation/repair techniques to identify those treated with labral debridement that would have fulfilled the current criteria for labral refixation. Different techniques may be employed when managing labral injury in the setting of isolated cam-type FAI. Therefore, only labral lesions due to pincer-type or combined pincer- and cam-type FAI were included to provide better matched groups with respect to labral management techniques.

The inclusion criteria in the debridement group included radiographic and intraoperative findings consistent with pincer- or combined pincer- and cam-type impingement and subsequent arthroscopic labral debridement and management of FAI before the use of labral refixation/repair techniques. All patients included in the study had magnetic resonance imaging (MRI), plain radiographs, detailed operative notes, and intraoperative images revealing a relatively healthy portion of the labrum available for refixation without complex tearing, intralabral ossification, or calcification. Additional inclusion criteria included minimal to no radiographic degenerative changes and a minimum 2-year follow-up. The inclusion criteria for the refixation group included labral refixation with radiographic and intraoperative findings consistent with pincer-type or combined pincer- and cam-type FAI and a minimum 2-year follow-up.

Over the study period (November 2004 to September 2007), 172 hips (166 patients) with minimal to no radiographic degenerative changes underwent arthroscopic management of FAI. The study period for refixation inclusion was extended by 2 months in the current study in comparison with our previous report. This resulted in the inclusion of an additional 15 labral refixations and a total of 100 hips meeting the inclusion criteria. The study period for the debridement group remained unchanged, as debridements before performing labral refixations were inclusion criteria. A total of 100 hips (96 patients) were identified that fulfilled the above criteria, and 94 hips (94%) achieved the minimum 2-year follow-up criteria. All patients who fulfilled the inclusion criteria with a minimum 2-year follow-up were included in the final cohort.

Before the development of labral refixation techniques at our institution (November 2004 to June 2006), 75 hips (73 patients) underwent arthroscopic treatment of FAI. Forty-six hips (44 patients) that underwent focal labral excision/debridement met the inclusion criteria (group 1). Two patients (2 hips) were lost to follow-up, leaving a total of 44 hips (42 patients) for inclusion with a minimum 2-year follow-up. There were 27 male and 17 female patients with a mean age of 32 years (range, 16-57 years). The mean follow-up was 44 months (range, 24-72 months). The preoperative diagnosis was isolated pincer-type impingement in 10 hips and combined pincer-type and cam-type impingement in 34 hips. Preoperative radiographs revealed Tonnis grade 0 to 1 changes in 42 hips and grade 2 changes in 2 hips.

After the development of labral refixation techniques (June 2006 to September 2007), 97 hips (95 patients) underwent arthroscopic treatment of FAI during the study period. Fifty-four hips (52 patients) underwent labral refixation and met the inclusion criteria (group 2). Four hips (4 patients) were lost to follow-up, leaving a total of 50 hips (48 patients) for inclusion with a minimum 2-year follow-up. There were 29 male and 21 female patients with a mean age of 28 years (range, 16-52 years). The mean follow-up was 41 months (range, 24-56 months). The preoperative diagnosis was isolated pincer-type impingement in 8 hips and combined cam-type and pincer-type impingement in 42 hips. Preoperative radiographs revealed Tonnis grade 0 to 1 changes in 48 hips and grade 2 changes in 2 hips.

The standard imaging evaluation and technique for arthroscopic management of FAI in the current cohort have been described in the previous report. In summary,
rim resections were performed over the area of acetabular overcoverage, and femoral resections were performed for cam-type FAI when present (Figure 1). Appropriate bony resections for FAI were evaluated with intraoperative fluoroscopy and confirmed with arthroscopic dynamic assessment. The senior author performed all surgical procedures with the patient in the supine position. In group 1, a focal excision of the labrum was performed along the area of acetabular overcoverage, leaving the remainder of the labrum intact. This provided exposure of the acetabular overcoverage and allowed for appropriate rim resection (Figure 2). In group 2, the labrum was taken down over the area of acetabular overcoverage, the prominent rim was resected, and labral refixation was performed (Figure 2).

Postoperative rehabilitation was guided according to the specifics of the procedure. Patients in group 1 (focal labral excision/debridement) were allowed to bear weight as tolerated with crutches until they were able to ambulate with a nonantalgic gait. In general, patients in group 1 typically required 2 to 3 weeks of crutch assistance. Patients undergoing labral refixation were kept toe-touch weight-bearing for 2 weeks with range of motion encouraged but avoiding the extremes of external rotation. Patients who underwent microfracture in either group were kept toe-touch weightbearing for 6 to 8 weeks.

Outcomes for both groups were prospectively measured with the modified Harris Hip Score (HHS), Short Form 12 (SF-12), and visual analog scale (VAS) for pain preoperatively and at 6 weeks, 3 months, 6 months, and yearly thereafter. Outcome scores were collected during clinic visits or by mail. Because of the tertiary care nature of the lead author’s practice, some patients were not able to return for objective follow-up at each of the previously mentioned time points. When scores were returned by mail, the patients were contacted by telephone to confirm that they received, filled out, and returned the scores themselves. Most recent outcomes were obtained at clinic visits for 29 patients in the debridement group and 29 patients in the refixation group. Most recent outcomes were obtained by mail for 13 patients in the debridement group and 19 patients in the refixation group. The senior author measured all alpha angles for patients with cam-type FAI on preoperative and 2-week postoperative anteroposterior pelvis and crosstable lateral radiographs. The Tonnis classification was used to grade radiographic degenerative changes preoperatively, and the degree of chondromalacia was graded according to the Outerbridge classification system.

The differences between preoperative and mean latest follow-up outcome measures were analyzed using paired-samples t tests, with a P value of <.05 used to determine significance. Differences between groups were analyzed using independent-samples t tests as well as ANOVAs where appropriate. For analyzing Tonnis grade, Mann-Whitney nonparametric t tests were utilized. Fisher exact tests were used to determine significant differences between failure rates and percentage of good/excellent. Finally, an a priori power analysis was performed. From our preliminary data, we estimated that a clinically significant between-groups difference in HHS would be 6.0 with a standard deviation in each group of 8.0. Using these numbers, a large effect size of 0.75 would be yielded, and thus to obtain a power of 0.80 or higher, each group would need to include at least 29 hips.

RESULTS

There were no statistically significant differences between groups for gender (P = .83), age (P = .43), FAI classification...
In addition, there were no statistically significant differences between groups for the degree of chondromalacia found intraoperatively on the acetabulum ($P = .34$) or femoral head ($P = .998$) (Table 1). Overall, 77% of hips in group 1 and 82% of hips in group 2 were found to have focal areas of grades 3 or 4 chondromalacia primarily involving the anterosuperior acetabular rim at the time of surgery. There were no statistically significant differences for microfracture or other additional procedures performed at the time of arthroscopy between groups (Table 2).

Most recent postoperative outcome measures were significantly improved compared with preoperative measures for both groups ($P < .01$). Modified HHS was significantly better in the refixation group (94.3) compared with the debridement group (84.9) at a mean latest follow-up of 3.5 years ($P = .001$) (Figure 3). In addition, SF-12 scores were significantly better in the refixation group (89.8) compared with the debridement group (82.2) ($P = .041$), and VAS scores were significantly lower in the refixation group (0.7 mm) compared with the debridement group (1.7 mm) at the mean latest follow-up ($P = .004$) (Figures 4 and 5). In addition, there was a greater mean improvement in outcome scores postoperatively for the refixation group compared with the focal labral excision/debridement group for HHS and SF-12 scoring (Table 3).

At most recent follow-up, good to excellent results (HHS >80) were noted for 68.2% of hips in the debridement group and 92% of hips in the refixation group ($P < .004$). Failure was defined as an HHS <70 or conversion to an open surgical approach such as open surgical dislocation (n = 1) or total hip arthroplasty (n = 1). The failure rate

**TABLE 1.**
Degree (Outerbridge Grade) of Chondromalacia Found Intraoperatively

<table>
<thead>
<tr>
<th>Outerbridge Grade</th>
<th>Group 1: Debridement</th>
<th>Group 2: Refixation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Acetabulum</td>
<td>Femur</td>
</tr>
<tr>
<td>0</td>
<td>3</td>
<td>31</td>
</tr>
<tr>
<td>1</td>
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<td>4</td>
</tr>
<tr>
<td>4</td>
<td>13</td>
<td>0</td>
</tr>
</tbody>
</table>

*Data are presented as the number of hips. There were no statistically significant differences between groups for the degree of chondromalacia documented at the time of arthroscopy.

**TABLE 2.**
Concomitant Procedures Performed at the Time of Arthroscopic Femoroacetabular Impingement Correction (Hips)

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Refixation</th>
<th>Debridement</th>
<th>$P$ value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microfracture</td>
<td>6</td>
<td>8</td>
<td>.563</td>
</tr>
<tr>
<td>Psoas Release</td>
<td>1</td>
<td>2</td>
<td>.598</td>
</tr>
<tr>
<td>Ligamentum Teres Debridement</td>
<td>5</td>
<td>8</td>
<td>.370</td>
</tr>
<tr>
<td>Loose Body Removal</td>
<td>0</td>
<td>1</td>
<td>.468</td>
</tr>
<tr>
<td>Os Excision</td>
<td>2</td>
<td>4</td>
<td>.414</td>
</tr>
<tr>
<td>Capsular Plication</td>
<td>5</td>
<td>3</td>
<td>.719</td>
</tr>
<tr>
<td>Sports Hernia Repair</td>
<td>1</td>
<td>1</td>
<td>.998</td>
</tr>
</tbody>
</table>

**Figure 3.** Harris Hip Scores were not significantly different preoperatively between groups. Scores were significantly better for the refixation group at 1 year postoperatively and were maintained throughout the remainder of the study at a mean follow-up of 3.5 years ($P = .001$).

**Figure 4.** Short Form 12 (SF-12) scores were not significantly different preoperatively between groups. The SF-12 scores were significantly better for the refixation group at the most recent follow-up of 3.5 years postoperatively ($P = .041$).
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was 9.1% (4 hips) in the debridement group compared with 8.0% (4 hips) in the refixation group ($P = .998$).

The mean decrease in alpha angles after femoral resection osteoplasty on anteroposterior and lateral radiographs was 18.4$^\circ$ and 28.2$^\circ$, respectively, in the debridement group compared with 15.4$^\circ$ and 25.2$^\circ$, respectively, in the refixation group. There were no statistically significant differences for femoral bone resection on anteroposterior or lateral radiographs between groups based on the reduction in alpha angle ($P > .05$).

Complications included 3 patients in the debridement group who developed heterotopic bone postoperatively. Two of these patients subsequently had revision hip arthroscopy and postoperative irradiation to remove symptomatic heterotopic bone. After recognizing this complication, subsequent patients were treated with naproxen (500 mg BID) for 3 weeks postoperatively. No patient in the repair/refixation group developed heterotopic bone postoperatively. Two other patients in the debridement group underwent revision femoral osteochondroplasty for inadequate initial decompression. In the repair group, one patient with a 2.5-cm full-thickness acetabular chondral defect at the time of arthroscopy underwent total hip arthroplasty at 1-year follow-up. Another patient in the repair group subsequently underwent revision hip surgery with an open surgical dislocation for a symptomatic posterior cam-type lesion at 2.5-year follow-up. Both of these patients in the repair group were considered failures. No patients sustained femoral neck stress fractures and iatrogenic hip instability or developed avascular necrosis postoperatively.

**DISCUSSION**

This study represents a mean 3.5-year follow-up of a prior study performed by the current authors. The principal findings of the current study were that labral refixation resulted in better HHS, SF-12, VAS scores, and a greater percentage of good to excellent results compared with an earlier cohort of labral debridements in the setting of arthroscopic management of pincer- and combined-type FAI at a mean 3.5-year follow-up. The results are in line with a previous study reported by the current authors with a minimum 1-year follow-up. The current cohort of 100 hips includes all patients from the prior study plus an additional 15 consecutive hips that underwent labral refixation.

Biomechanical and finite element model analyses have shown that the acetabular labrum may contribute to hip joint stability and hip joint congruity and may function to distribute synovial fluid through a sealing function. In a sheep model, surgically induced labral tears were repaired with a single suture anchor, and all specimens were later found to heal via fibrovascular scar tissue to the capsule and/or underlying acetabular bone. There are limited data indicating good short-term results and no long-term follow-up after arthroscopic labral repair/refixation in humans.

A previous study looked at labral refixation versus excision performed with an open surgical dislocation technique for FAI. They found significantly better outcomes at 1 and 2 years in the refixation group when compared with the labral excision group. This was a consecutive series of patients, and similar to the current study, it may be that improvements in the latter refixation group were the result of a combination of labral preservation and improved technique for managing this disorder over time. A recent study evaluated labral repair versus labral debridement in 96 patients with a minimum 2-year (mean, 2.44 years) follow-up who underwent arthroscopic management of FAI. Modified HHS was significantly better in the repair group compared with the debridement group. Another study evaluating the results of arthroscopic FAI correction with a minimum 2-year follow-up found that labral repair, rather than debridement, was a predictor of higher HHS. The 2 previously mentioned studies, however, looked at repairs and debridements that were done during the same time period. Hips that underwent repairs, therefore, may have had less labral damage, degenerative changes, or different patterns of impingement when compared with debridements, making it difficult to determine how well the 2 groups were matched.

The current study represents further follow-up on a cohort that was the first to compare the results of arthroscopic labral debridement and labral refixation. All procedures were performed by the same surgeon using the same prospectively collected outcome scoring. Additionally,
the cohorts were of sufficient size to detect measurable differences based on power analysis. Better outcome scores noted at the most recent follow-up of 3.5 years in the refixation group compared with the debridement group are in line with the results previously published by the current authors at a minimum 1-year follow-up and in a prior study evaluating patients managed with an open dislocation technique with 2-year follow-up. The current results differ from the previous report by the current authors in that there were better SF-12 and lower VAS scores in addition to better HHS in the refixation group compared with the debridement group at most recent follow-up. It should be noted that outcome scores for both refixation and debridement groups were significantly improved postoperatively in the current study.

In a previous study utilizing an open surgical dislocation technique, a routine labral takedown, rim trim, and labral refixation were performed as part of the procedure regardless of the presence or absence of labral tearing. In the current study, the diagnosis of pincer-type and combined pincer- and cam-type FAI was chosen to create a more homogeneous group of patients, all of whom had evidence of labral injury and underwent refixation of a torn or damaged labrum. Patients with isolated cam-type impingement, for which management of a torn labrum may differ, were not included in the current study.

This study does have significant recognized shortcomings as mentioned in our initial report. Most evident are the limitations imposed by the use of a historical control. Every effort was made to properly match patients in the historical debridement group with those selected for labral refixation, but the potential bias cannot be eliminated. The current cohort differs slightly from our prior report with the inclusion of 15 additional hips in the refixation group by extending the study period by 2 months. The surgical technique and indications, however, remained the same, and this allowed us to include a total of 100 hips for further evaluation over time. It may be most important to recognize that there is a steep learning curve when arthroscopically managing FAI. Similar to the previous study using an open surgical dislocation technique, it is possible that improvements seen in the later refixation group could be affected by improved techniques for management of FAI and a better understanding of this disorder over time. This is evident with 2 revision surgeries for the removal of symptomatic heterotopic bone before routine use of postoperative nonsteroidal anti-inflammatory drugs and 2 revision femoral osteochondroplasties for inadequate decompression in the debridement group. There was, however, one patient in the later refixation group who had a subsequent open surgical dislocation for persistent posterior cam-type impingement that was not accessible arthroscopically. Although radiographic improvements in the alpha angle were not significantly different between the 2 groups, cam-type impingement is a 3-dimensional entity, and significant improvements for the management of cam-type impingement with greater experience may not be reflected by plain radiographs alone. In addition, improved management of pincer-type impingement with greater experience may have also influenced the results of the current study. Differences between groups with respect to the amount of rim resection and correction of pincer-type impingement, however, would also be difficult to evaluate without postoperative 3-dimensional imaging. It should also be noted that the technique of labral debridement in the current study consisted of a focal labral excision. In recent years, labral debridement techniques in the setting of pincer-type impingement have evolved.

Figure 5. Visual analog scale (VAS) scoring was not significantly different between groups preoperatively. The VAS scores were significantly better for the refixation group at the mean latest follow-up of 3.5 years postoperatively (P = .004).

REFERENCES


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